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Composite Body Comprising a Decorative Layer

The invention concerns a composite body, consisting of a carrier and at least one decorative layer of a natural material which is connected thereto.

Composite bodies of this type are known and are used e.g. as floor coverings, such as parquet or as inlaid works, e.g. tarsia, wherein the carrier generally consists of wooden or pressboard plates. Parquet boards made from soft wood carriers are known onto which small layers of fine wood of different shapes are glued, wherein one distinguishes between mosaic parquet with mosaic-like composition of the glued-on layers and parquet lamellas with layers which are glued on, e.g. in a square pattern.

For ornamental or figurative tarsia, a plate-shaped carrier of wood or pressboard is provided with the required recesses which are filled with materials, e.g. wood, ivory, mother-of-pearl, real shell, decorative stones or metal, wherein the fillers are usually also glued-in. The manufacture of such composite bodies, in particular for tarsia, is demanding and expensive since the recesses in the wooden or pressboard plate must be produced by cutting while maintaining close tolerances. Production of such composite bodies furthermore

requires large amounts of glue. It is often necessary to grind the surface to compensate for uneven surfaces due to mismatch or excessive thickness tolerances of the fillers.

It is the underlying purpose of the invention to present a composite body of the above-mentioned type having considerably reduced production costs and which permits manufacture without glue, as well as a method for producing a composite body of this type.

The first part of this object is achieved in accordance with the invention by a composite body of the above-mentioned type in that the carrier consists substantially of at least one natural and/or synthetic thermoplastic or thermoelastic polymer.

Replacement of the wooden carrier with a carrier consisting of a thermoplastic or thermoelastic polymer permits simple and inexpensive production of the inventive composite body e.g. by pressing the decorative layer into the carrier which has been heated at least to a temperature at which the polymer starts to flow. The connection between carrier and decorative layer is thereby achieved through positive fit as well as by penetration of the molten polymer mass into at least the directly bordering surface of the usually rough or open-pored structure of the decorative layer made from natural materials. This guarantees a stable, rigid and glue-free connection. If desired, the inventive composite body can comprise inserts of different decorating materials, such as

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wooden veneer, mother-of-pearl, real shell, decorative stones, metal, leather, cork or other esthetic materials, which are pressed into the carrier. The carrier can be coated with one or more wooden veneers, in particular of different colors, to obtain ornamental or figurative patterns, wherein the veneers can form a smooth or profiled surface or the veneers are disposed in different planes, parallel to the carrier, thereby forming a three-dimensional surface. The carrier can be substantially plate-shaped but also have any other shape, e.g. square, cylindrical etc.

If the carrier consists of a synthetic polymer, all known thermoplastic or thermoelastic polymers, such as polyolefines, polyamides, polyesters, polyacetates, polycarbonates, polyurethanes, vinylpolymers or copolymers thereof can be used.

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Conservation of mineral oil resources, from which the basic materials for plastic synthesis are gained, leads to the wish of replacing synthetic polymers with natural polymers. This aim is made even more attractive by the fact that burning of synthetic plastic materials, which is often the only possibility of waste disposal, produces considerable CO<sub>2</sub> emissions, often accompanied by toxic emissions. A preferred embodiment therefore provides that the carrier substantially consists of a natural polymer on the basis of lignin.

Polymers of growing natural raw materials have an ecologically neutral CO<sub>2</sub> balance since burning of natural polymers does not emit more CO<sub>2</sub> into the atmosphere than is

withdrawn during growth of the raw materials. Moreover, in particular biologically decomposable or compostable natural polymers are of primary interest since they are decomposed usually without any residue in a considerably shorter period of time.

While plastic materials on the basis of natural polymers or natural polymers modified through oxidation, enzyme treatment or the like have worse material properties than synthetic plastic materials, lignin is characterized by high strength, high rigidity, and high impact strength as well as high resistance with respect to ultra-violet light. Lignin is furthermore a suitable material for heat and sound insulation. Lignin is a high molecular polyphenolic macromolecule which fills the spaces between the cell membranes of ligneous plants and turns them into wood thereby producing a mixed body of pressure-resistant lignin and cellulose having good tensile strength. Large quantities of lignin are produced as a by-product in cellulose production and are therefore available in large amounts. Disintegration of wood produces lignosulphonic acids as part of the sulfite waste liquor in which the lignosulphonic acids are dissolved in the form of phenolates ("alkalilignin"). The ligneous acid can be precipitated through treatment with sulfuric acid and carbon dioxide. Due to its wide availability, powdery alkalilignin, as extracted from the treatment of cellulose processing waste water through evaporation, which has largely been burned up to now, or as dissolved in alcohols, such as

glycol, can be used for producing the inventive composite body.

It is also possible to use a lignin-containing natural granulated material in accordance with EP 0 720 634 B1 which is produced from alkalilignin and proteins or protein derivatives and is produced by stereochemical modification through treatment with organic acids, in particular acetic acid and which can be thermoplastically processed into shaped parts. This material can be disintegrated and composted.

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The carrier of the inventive composite body can also consist of a polymer blend of at least one synthetic and at least one natural polymer, in particular lignin. Combination of different polymers permits in particular combining of properties of the two polymer components which are favorable for the respective intended use of the composite body or to emphasize the desired material properties of one polymer component while the undesired material properties of this component are covered to a certain extent by the other component, in dependence on the mixing ratio. This permits production of composite bodies whose properties can be adjusted to the respective technical use.

To achieve increased stability of shape, the carrier can be reinforced with reinforcing fibers, wherein preferably natural fibers, e.g. hemp, cellulose, wood fibers or the like are used for the reasons mentioned above.

A preferred embodiment provides that the inventive composite body comprises a wooden veneer as decorative layer. A further embodiment provides that the composite body comprises a decorative layer (alternatively or additionally) of fleece, interlacing, woven fabric, knitted fabric, plaited material, or the like made from natural fibers. In the case of a wood veneer, the composite body can comprise a fleece, interlacing, woven fabric, knitted fabric, plaited material or the like between the carrier and the wooden veneer. Same preferably consists of natural fibers such that the inventive composite body consists completely of natural materials, in particular in connection with a lignin-based carrier. The fleece, interlacing, woven fabric, knitted fabric or plaited material can e.g. consist of flax, sisal, ramie, miscanthus, cellulose or wood fibers. In a preferred embodiment, hemp fibers are used which have excellent material properties, such as high tensile strength, compared to other natural fibers. The interlacing, woven fabric, knitted fabric or plaited material serves as adhesive agent between the carrier and the wooden veneer and prevents e.g. bleeding through of the molten polymer mass during pressing.

The inventive composite body is suitable for many applications. Due to its range of characteristics, color and consistency, it is suitable as a substitute for composite bodies which completely consist of wood or wooden materials. Due to the good heat and sound insulating properties of lignin, the composite body is suitable, in particular, for

floor coverings such as parquets, for wall and ceiling paneling or the like.

The inventive composite body is also suited in particular for inlaid works, e.g. tarsia, in that the base plate, which usually consists of wood or pressboard, is replaced by the e.g. plate-shaped carrier which consists of at least one natural and/or synthetic thermoplastic or thermoelastic polymer. The inventive composite body is suited e.g. as an ornamental visible side of furniture, musical instruments, housings of all kinds, vehicle interior paneling and fittings, such as dashboards, steering wheels, central consoles or the like.

The second part of the inventive object is achieved by a method of producing a composite body of the kind categorizing the invention in that the decorative layer is pressed into a carrier, consisting of at least one natural and/or synthetic thermoplastic or thermoelastic polymer, at increased pressure and increased temperature.

The decorative layer is preferably inserted into a hot press, the carrier is disposed thereon and the decorative layer is pressed into the surface of the carrier by closing the press.

In this fashion, it is possible to introduce decorative layers and optionally additional (preferably natural) materials, such as wood, ivory, mother-of-pearl, real shell, decorative stones or the like into the carrier without

necessitating extensive preparation of the carrier, such as e.g. providing recesses. If the carrier consists in particular of lignin, the composite body looks and feels wooden, due to the wood-like character of lignin.

The pressure is preferably between 40 and 400 bar depending on the polymer or polymer mixture of the carrier used. The pressing temperature is preferably between 120 and 180°C and corresponds to at least the temperature of the melt transition region of the polymer used for the carrier.

The pressing depth of the decorative layer can be varied such that it either corresponds substantially to its thickness, wherein the composite body has a smooth surface, or the pressing depth is selected to be somewhat smaller than the thickness of the decorative layer, wherein different decorative layers can be disposed in several parallel planes, which gives an impressive appearance, in particular for tarsia. The decorative layers can be inserted into the hot press, partly covering or overlapping one another and form a smooth surface immediately after pressing.

In a preferred embodiment, in particular after introducing a decorative layer in the form of wooden veneers into the hot press, an interlacing, woven fabric, knitted fabric, plaited material or the like, in particular of natural fibers, is disposed onto the decorative layer to prevent bleeding through of the molten polymer mass or liquid component

thereof onto the surface of the decorative layer to guarantee a solid, glue-free compound.

When wooden veneers are used, it is possible to emboss a surface structure onto the covering layer in that e.g. a profile on the inner surface of the hot press facing the veneer penetrates into the veneer when closing the hot press. The inner surfaces of the hot press facing the veneer can be modified to produce rough or leathery surfaces for the decorative layer without requiring an additional step.

The carrier can be mixed in particular with natural reinforcing fibers, such as hemp, cellulose, wood fibers or the like before pressing in the decorative layer.

The invention is described below with reference to an embodiment shown in the drawing, in the form of an inlaid work, e.g. a chessboard, which consists of an inventive composite body.

The inventive composite body shown in Fig. 1 consists of a plate-shaped carrier 1 of lignin and several wooden veneers 2 pressed into the carrier 1, of several colors and arranged like a chessboard. The dark veneers 2a can be made e.g. from root timber and the light veneers 2b can be made e.g. from maple wood. The strips 2c limiting the chessboard-shaped pattern can be formed directly by the carrier, in particular of lignin, while the field identifiers 2d are cut e.g. from a veneer of cherry wood. The composite body shown has a smooth

surface which can be easily fashioned through insertion of the individual veneers 2a, 2b and 2d in a hot press and subsequent pressing together with the carrier 1. A woven fabric of hemp fibers can e.g. be disposed between the carrier and the wooden veneer 2 which prevents bleeding through of the plastified lignin or its easily fusible components onto the surface during the pressing process and guarantees a solid composition.